Las Animas

Aerated Lagoon

View of wetland cells

Removable sleeves are used to control the water elevation in the wetland cells.

Fines from unwashed media results in plugging

Las Animas Facility Statistics	
Nearest Town:	**Las Animas**
County:	**Bent**
River Basin:	**Lower Arkansas**
Receiving Water Body:	**Diversion Ditch routed to Arkansas River**
Year Online:	**1999**
Population:	**2500 + 1000 inmates**
Elevation (feet):	
Design Flow (mgd):	**0.50**
Average Flow (mgd):	**0.25**
Size (acres):	**2.1**

Facility Description

The Las Animas wastewater treatment system is a domestic minor municipal lagoon system. The facility consists of a continuous influent flow-measuring device, two aerated lagoons, one settling pond, a constructed wetland, ultraviolet disinfection and a continuous effluent flow-measuring device.

Lagoons

Some of the features of the Las Animas lagoon system are detailed in the table below.

Lagoon Information			
Cell No.:	**1**	**2**	**3**
Surface Area (sq. ft.)	**540,000**	**540,000**	**250,000**
Avg. Depth (ft)	**4.1**	**4.1**	**6.0**
Avg. Volume (Million gallons)	**16.56**	**16.56**	**11.22**
Detention time (days)	**7**	**6.6**	**2.9**
Aerator size (hp)	**100**	**14**	**7.5**

Background Information

The Las Animas wastewater treatment plant was initially constructed in 1958 as a three-cell, facultative lagoon system, with a design capacity of 0,22 mgd. The plant was later expanded in 1983 to a four-cell, facultative lagoon system, with a design capacity of 0.36 mgd. The only unusual waste source in the City's service area is that coming from blowdown from water softeners in the community. The City has experienced problems with meeting discharge requirements since the system came online in 1983. These violations are attributed to high TSS related to algae growth. In October 1986 the City of Las Animas was issued a Notice of Violations and Cease and Desist Order. The City had several violations, including violations of BOD5 percent removal, BOD5 concentrations, TSS concentrations, pH exceedances, and fecal coliform exceedances that persisted through the summer of 1994.. Constructed wetlands were chosen to be the most promising method to achieve algae removal.

The City undertook a 3-year pilot scale study, starting in October 1991, to design and construct 4 pilot scale wetlands. Each wetland was 20 x 40 feet, 3 feet deep, had a 2% slope, and was planted with 200 locally harvested cattails. Each was loaded at 1000 gpd. Three of the wetlands were designed to be subsurface. Gravel size was varied for each wetland (4", 1.5" and .75" sizes were tested). The fourth wetland cell was designed as a surface flow system. The results from this study were used to design the full size subsurface wetland system.

Energy Analysis

The wetland system operates under gravity. Energy is consumed by the aerators in the lagoons, and by the UV disinfection system.

Wetland Design

Design Methods

Results from the pilot scale study were used to design a full size subsurface system. Some of the conclusion from this study that were used in the final design are discussed below.

- The surface flow wetlands did not consistently remove algae, in fact, at times algae cell numbers increased due to algae growth in the system. This was due to a short detention time in the surface flow wetland.
- The subsurface wetlands significantly removed algae cells.
- No plugging occurred in the subsurface wetlands. Performance increased as the gravel size decreased. In addition, the two coarser gravel wetlands had poorer plant development compared to the finer gravel wetland.
- The subsurface wetlands were oxygen limited for nitrification but had sufficient oxygen for BOD5 removal.
- The subsurface wetland with a 0.75 inch gravel size was chosen for the full scale wetland because of its performance in algae removal and BOD5 and TSS reduction without plugging problems during its two years of operation.

Objectives

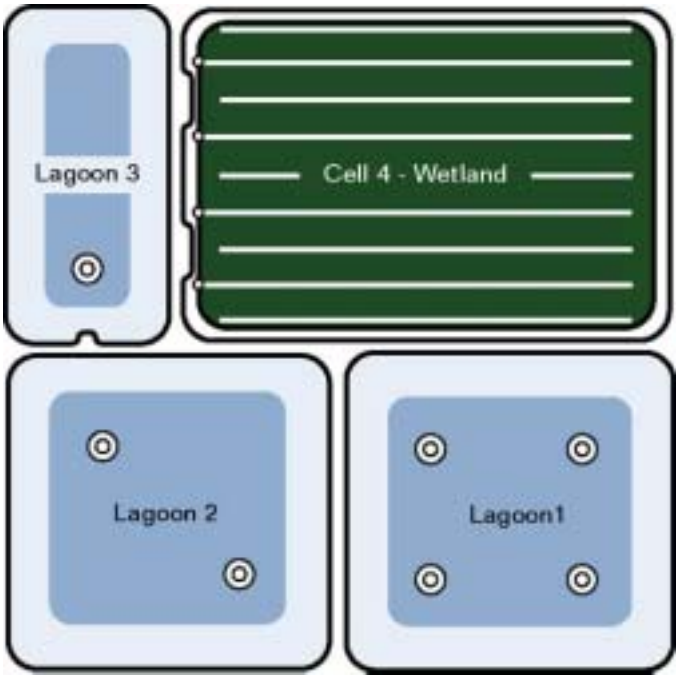
The wetland was sized using empirical data collected during the pilot scale study. The primary objective of the wetland component was to remove BOD and TSS from the lagoon effluent.

Size

An existing lagoon was retrofit to include the subsurface wetland cells.

Shape

As shown by the schematic, the wetland cells are rectangular.



Hydraulics

Lagoon effluent is introduced into the wetland cells by perforated pipes installed approximately 36” below the ground surface. PVC piping was used. PVC risers distribute the water within the wetland. Adding or removing collars onto PVC tees within effluent collection boxes controls the water level. At the time of the visit, the system was experiencing plugging problems. A potential cause of the plugging was theorized to be the use of unwashed gravel in the wetland cells. Hypochloride was being introduced into the pipes to clean them out.

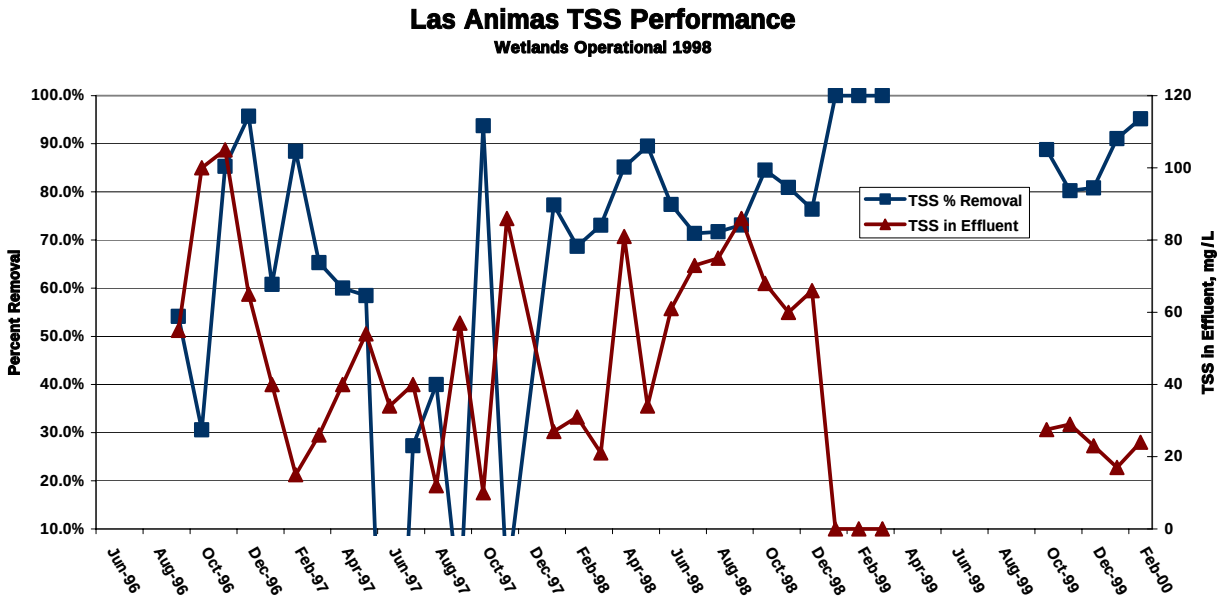
Treatment Goals

Permitted Discharge Limitations	
Oil and Grease:	**10 mg/l (Daily Max)**
BOD_5:	**30 mg/l (30-day ave)**
BOD_5 Removal:	**85%**
TSS:	**105 mg/l (30-day ave)**
PH, su (min – max) :	**6.5 – 9.0 (Daily Max)**
Ammonia (as N):	**26.7 (lbs/day)**
Chlorine Residual:	**0.026 mg/l (Daily Max)**
Fecal Coliform Bacteria:	**6,000 organisms per 100 ml (Daily Max)**

Water Quality Data

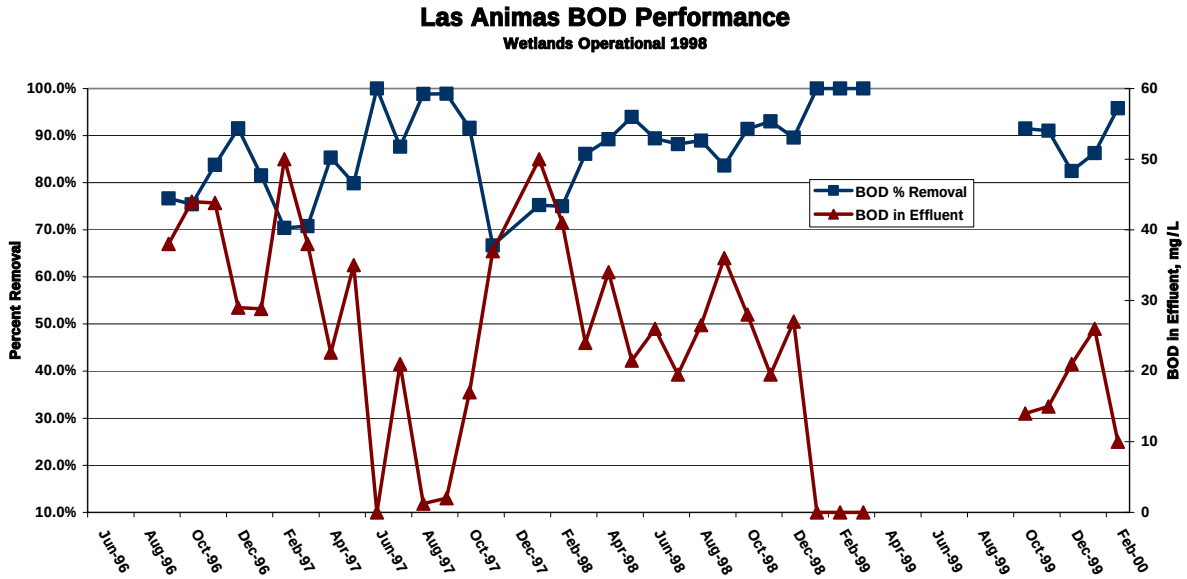
TSS Data

The TSS graph plots the percent removal on the left axis and TSS in mg/l in the effluent on the right axis. The average monthly TSS in the influent, since the wetland implementation, has been 240 mg/l and the average monthly effluent has been 24 mg/l. This meets the permit discharge requirement of 105 mg/l.



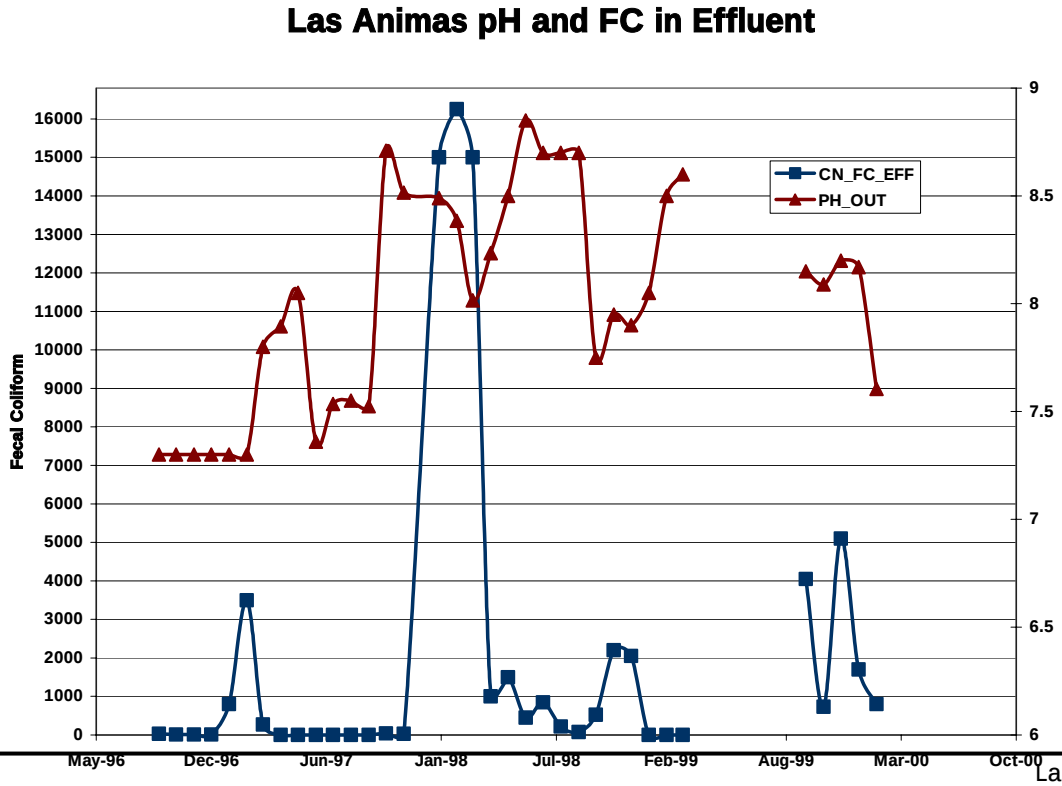
BOD Data

The BOD data is plotted similarly to the TSS data, with mg/l in the effluent on the right axis, and percent removal on the left axis. The average monthly influent amount has been 176 mg/l and the average monthly effluent amount has been 17 mg/l.



pH and Fecal Coliform

Data for these two categories have been plotted on the same graph. Data reflect the quality of the effluent; no influent measurements are taken for these parameters. The pH values plotted are an average of the minimum and maximum 30-day values that are reported in the monthly reports. Since the wetland implementation, pH values have consistently stayed within the allowable range of 6.5 to 9.



General Ecological Setting

The Las Animas constructed wetland is flat, rectangular, and are 90 percent vegetated and 10 percent rock. The wetland discharges into the Arkansas River. The treatment wetland is located on the north side of the Town of Las Animas, near the Arkansas River floodplain.

Cell Vegetation

Two vegetation types are present in the wetland cell. Plant community 1, which comprises 80 percent of the wetland, is dominated by cattail (*Typha latifolia*), narrow leaved cattail (*Typha angustifolia*), and softstem bulrush (*Scirpus tabernamontanae*). Curley dock (*Rumex crsipus*), witchgrass (*Panicum capillare*), and switchgrass (*Spartina pectinata*) are present but not dominant. Plant community 2 accounts for 20 percent of the cell's vegetation cover. It is dominated by cattail, softstem bulrush, and ragweed (*Amaranthus retroflexis*), with tamarisk (*Tamarix chinensis*) and gumweed (*Grindelia squarosa*) present but not dominant.

Planting/Seeding

The site was planted with cattail and softstem bulrush to encourage vegetation establishment.

Weeds

Tamarisk or saltcedar (*Tamarix chinensis*), a noxious weed, is a facultative phreatophyte, i.e., it can draw water from underground sources, but once established it can survive without access to ground water. It consumes large quantities of water, possibly more than woody native plant species that occupy similar habitats. Tamarisk is a maintenance concern and is commonly controlled in riparian areas and wetlands because of its potential to displace native vegetation and its lower value as wildlife habitat.

Maintenance Issues

The water level for the wetland cell is about 1.5 feet below the design elevation of about 3 to 6 feet below the surface, which has resulted in plants drying up and dying. This die-off is particularly significant in community 2, where vegetative cover is only 50 percent. Community 1 has 80 to 90 percent vegetative cover. In addition, gravel at the mouth of the distribution pipe is causing clogging. A strategy should be developed to mitigate this.

Wildlife

The Las Animas wetland provides habitat for red winged black birds, songbirds, and potentially muskrats. No wildlife species were observed during the site visit. The site is located near the Arkansas River floodplain, and is not a unique feature in the area. Riparian areas along the river, and wetlands and open water associated with the John Martin Reservoir likely provide more valuable habitat. Because there are some gravel areas devoid of vegetation, there is some structural diversity, but this is probably not very valuable to wildlife.

Wetland Biodiversity Functional Assessment

Sediment/nutrient/toxicant removal rated high in this wetland. General wildlife habitat and production export/food chain support rated moderate. Habitat diversity and uniqueness of the constructed wetland rated

low. The wetland received 35 percent of the total possible functional points and was rated as a category III wetland.

Wetland Biodiversity Functional Assessment.

Function and Value Variables	Functional Points (0.1 to 1)	Possible Points
General Wildlife Habitat	0.4 (mod.)	1
General Fish / Aquatic Habitat	NA	1
Production Export / Food Chain Support	0.4 (mod.)	1
Habitat Diversity	0.1 (low)	1
Uniqueness	0.2 (low)	1
Total Points	2.1 (42%)	5
Wetland Category (I, II, III, or IV)	III	

Human Use

The wastewater wetland is part of a restricted public access area, and has never been used for educational purposes. This wetland has moderate aesthetic value. It is dominated mainly by emergent vegetation, but has some openings composed of bare gravel.

A pilot scale wetland study was performed at this site[1]. The results of this study were used in the design of the existing facility. Several subsequent wetland systems have cited this study for design parameters.

Overall Site Comments

This wetland functions effectively in the treatment of wastewater, and vegetation has established over most of the site. Problems with the water distribution system into the wetlands may adversely impact vegetation establishment and health if the problems are not addressed, but the plant operators are taking a proactive role in addressing these problems.

[1] Richard, Michael Ph.D., and Snyder, John M.S., "Results of the Pilot Wetlands Study at Las Animas, CO, Final Report", submitted to John Trent Public Works Director, City of Las Animas, CO, February 10, 1994.